ABSORBENT ARTICLE WITH BREATHABLE BACKSHEET COMPRISING OCCLUDING FLUID PASSAGEWAYS

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FIELD OF INVENTION

This invention relates to a resilient, three dimensional, fluid pervious polymeric web and absorbent articles with a breathable backsheet that comprises the same.

BACKGROUND OF THE INVENTION

The development of absorbent articles is driven by at least two needs of the consumer, protection and comfort. Breathable backsheets in absorbent articles are designed to provide a comfort benefit to consumers. An example of breathable backsheets, includes microporous films and apertured formed films both having directional fluid transfer, such as disclosed in U.S. Patent No. 4,591,523 issued to Thompson. Both of these types of breathable backsheets are air and vapor permeable, allowing gaseous exchange with the environment and increased circulation within the absorbent article, so that a portion of the fluid collected in the core evaporates. Although in principle breathable backsheets only allow the transfer of materials in the gaseous state, physical mechanisms such as extrusion, diffusion and capillary action, may still occur and result in the transfer of the fluids from the absorbent core through the backsheet and onto the users garments. One attempt to solve the problem of compromised consumer protection, is the use of a dual backsheet having one layer with slanted capillary apertures, such as disclosed in U.S. Patent No. 6,413,247 issued to Carlucci, et al.

Despite attempts by those skilled in the art to provide an acceptable level of protection with the use of breathable backsheets, current films or webs used for breathable backsheets are too flexible to remain breathable when dry or are too rigid to close apertures and become pervious when wetted. The inventors believe that the polymeric web and the breathable backsheet of the present invention are both comfortable and provide an acceptable level of protection for the consumer. The present invention comprises polymeric web that has a plurality of fluid passageways comprising side walls extending between surfaces of the web. The polymeric web comprises an occluding material, which causes a mechanical change in the sidewalls of the fluid passageways upon contact with fluid rendering the surfaces of the web to be in non-fluid communication with one another, thus providing an effective leakage barrier.

SUMMARY OF THE INVENTION

The present invention includes a resilient, three dimensional, fluid pervious polymeric web and an absorbent article with a breathable backsheet comprising the same. The resilient, three dimensional, fluid pervious polymeric web has a first surface and a second surface generally parallel to and spaced apart from the first surface. The polymeric web also has a plurality of fluid passageways comprising side walls extending between the first surface and the second surface to place the first surface and the second surface in fluid communication with one another. The polymeric web further includes an occluding material, which causes a mechanical change in the sidewalls of the fluid passageways upon contact with fluid rendering the first surface and the second surface to be in non-fluid communication with one another at the fluid passageways.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a partial cut away plan view of an absorbent article comprising the breathable backsheet of the present invention.

FIG. 2 shows a transverse cross-section of an absorbent article comprising the breathable backsheet of the present invention.

FIG. 3 shows a cross section of a fluid passageway of the three dimensional, fluid pervious polymeric web.

FIG 4A shows a cross section of a fluid passageway of the three dimensional, fluid pervious polymeric web with the occluding material totally exposed at the first opening of the fluid passageway.

FIG 4B shows a cross section of a fluid passageway of the three dimensional, fluid pervious polymeric web with the occluding material partially exposed at the first opening of the fluid passageway.

FIG 4C shows a cross section of a fluid passageway of the three dimensional, fluid pervious polymeric web with the occluding material unexposed at the first opening of the fluid passageway.

FIG. 5 shows a cross section of a fluid passageways of the three dimensional, fluid pervious polymeric web.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, the term "**bicomponent fibers**" refers to fibers that have been formed from at least two different polymers extruded from separate extruders but spun together to form one fiber. Bicomponent fibers are also sometimes referred to as conjugate fibers or multicomponent fibers. The polymers are arranged in substantially constantly positioned distinct zones across the cross-section of the bicomponent fibers and extend continuously along the length of the bicomponent fibers. The configuration of such a bicomponent fiber may be, for example, a sheath/core arrangement wherein one polymer is surrounded by another or may be a side-by-side arrangement, a pie arrangement or an "islands-in-the-sea" arrangement.

As used herein, the term "**biconstituent fibers**" refers to fibers that have been formed from at least two polymers extruded from the same extruder as a blend. Biconstituent fibers do not have the various polymer components arranged in relatively constantly positioned distinct zones across the cross-sectional area of the fiber and the various polymers are usually not continuous along the entire length of the fiber, instead usually forming fibrils which start and end at random. Biconstituent fibers are sometimes also referred to as multiconstituent fibers.

As used herein, the term "**capillary channel fibers**" refers to fibers having capillary channels capable of facilitating fluid movement via capillarity. Such fibers can be hollow fibers, for example, but are preferably fibers having capillary channels on their outer surfaces. The capillary channels can be of various cross-sectional shapes such as "U-shaped," "H-shaped," "C-shaped," and "V-shaped."

The term "**joined**" or "**attached,**" as used herein, encompasses configurations in which a first element is directly secured to a second element by affixing the first element directly to the second element; configurations in which the first element is indirectly secured to the second element by affixing the first element to intermediate member(s) which in turn are affixed to the second element; and configurations in which the first element is integral with the second element; i.e., the first element is essentially part of the second element.

As used herein, the term "**meltblowing**" refers to a process in which fibers are formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries as molten threads or filaments into converging high velocity, usually heated, gas (for example air) streams which attenuate the filaments of molten thermoplastic material to reduce their diameter, which may be as small as microfibers. Thereafter, the meltblown fibers are carried

by the high velocity gas stream and are deposited on a collecting surface, often while still tacky, to form a web of randomly dispersed meltblown fibers. Meltblown fibers are microfibers, which may be continuous or discontinuous and are generally smaller than 10 microns in average diameter.

As used herein, the term **"monocomponent"** fiber refers to a fiber formed from one or more extruders using only one polymer. This is not meant to exclude fibers formed from one polymer to which small amounts of additives have been added for coloration, antistatic properties, lubrication, hydrophilicity, etc. These additives, for example titanium dioxide for coloration, are generally present in an amount less than about 5 weight percent and more typically about 2 weight percent.

As used herein, the term **"nonwoven web"** refers to a web having a structure of individual fibers or threads which are interlaid, but not in a regular, repeating manner as in a woven or knitted fabric. Nonwoven webs or fabrics have been formed from many processes, such as, for example, meltblowing processes, spunbonding processes, hydroentangling processes, and bonded carded web processes. The basis weight of nonwoven fabrics is usually expressed in grams per square meter () and the fiber diameters are usually expressed in microns. Fiber size can also be expressed in denier. The basis weight of nonwoven webs useful as components of the present invention, such as the facing layer (which can be a single layer or a composite of more than one layer), can range from 10 to 200 .

The constituent fibers of nonwoven webs can be polymer fibers, which may include can be monocomponent, bicomponent and/or biconstituent, capillary channel fibers, having a major cross-sectional dimensions (e.g., diameter for round fibers) ranging from 5-200 microns. The constituent fibers can range from about 0.1 denier to about 100 denier.

As used herein, the term **"polymer"** generally includes, but is not limited to, homopolymers, copolymers, (such as for example, block, graft, random and alternating copolymers, terpolymers, etc.,)and blends and modifications thereof. In addition, unless otherwise specifically limited, the term "polymer" includes all possible geometric configurations of the material. The configurations include, but are not limited to, isotactic, atactic, syndiotactic, and random symmetries.

As used herein, **"spunbond fibers"** refers to small diameter fibers that are formed by extruding molten thermoplastic material as filaments from a plurality of fine, usually circular capillaries of a spinneret, with the diameter of the extruded filaments then being rapidly reduced.

Spunbond fibers are generally not tacky when they are deposited on a collecting surface. Spunbond fibers are generally continuous and have average diameters (from a sample of at least 10) larger than 7 microns and more particularly between about 10 and 40 microns.

FIG. 1 and **FIG. 2** show one embodiment of an absorbent article of the present invention. **FIG. 1** and **FIG 2** show a sanitary napkin **20** comprising a fluid permeable facing layer **21**, breathable backsheet **22**, and a first absorbent layer **24** joined to the facing layer **21**. Facing layer **21** and breathable backsheet **22** can be joined about a periphery **27**. Facing layer **21** of sanitary napkin **20** can be a body-contacting layer commonly known in the art as a topsheet **26**. Facing layer **21** can be a composite comprising a topsheet **26** and a second absorbent layer, not shown in **FIG. 1** or **FIG. 2,** but also known in the art. An optional second absorbent layer **25** can be disposed between first absorbent layer **24** and breathable backsheet **22**.

The sanitary napkin **20**, as well as each layer or component thereof can be described as having a "body facing" surface and a "garment facing" surface. As can be readily understood by considering the ultimate use for sanitary napkins, the body facing surfaces are the surfaces of the layers or components that are oriented closer to the body of the user when in use, and the garment facing surfaces are the surfaces that are oriented closer to the undergarment of the user when in use. Therefore, for example, facing layer **21** has a body facing surface **30** and a garment facing surface **31** that is the surface that can be adhered to the underlying first absorbent layer **24**. The garment facing surface **32** of the fluid impermeable backsheet **22** of a sanitary napkin, for example, is oriented closest to and may contact the wearer's panties in use (via adhesive attachment means, if used).

Sanitary napkin **20** can have side extensions **28**, commonly referred to as "wings," designed to wrap the sides of the crotch region of the panties of the user of sanitary napkin **20**. Sanitary napkin **20** and/or wings **28** can have fastening means including attachment components, such as pressure sensitive adhesive, or mechanical fasteners such as hook and loop fasteners. The sanitary napkin **20** shown in **FIG. 1** and **FIG. 2** has strips of positioning adhesive **36** on the garment facing surface **32** of breathable backsheet **22**. The positioning adhesive **36** can be a hot-melt adhesive material capable of establishing a temporary bond with the undergarment material. A suitable material is the composition designated HL-1491 XZP, commercially available from H. B. Fuller, Toronto, Ontario, Canada. The fastening means can include attachment components such as positioning adhesive **36,** disposed on the extensions **28**, as shown in **FIG. 1** and **FIG. 2**. The positioning adhesive **36**, or other attachment components can be applied to the garment facing surface **32** of the breathable backsheet **22** in various patterns including a complete adhesive

coverage, parallel longitudinal strips or lines, a line of adhesive following the perimeter of the structure, transverse lines of adhesive, and the like, or any combination thereof.

In general, the presence of fastening means defines an attachment zone that is coextensive with the fastening means. The attachment zone is the portion of the sanitary napkin, typically the backsheet thereof, that is fixed with respect to the wearer's panties. The sanitary napkin **20** can be made by hand or on commercial high-speed production lines, as is known in the art.

Facing layer **21** may, in some embodiments, comprise extensible nonwoven materials or extensible apertured polymer films, as are known in the art for topsheets on disposable absorbent articles. For example, facing layer **21** can comprise an apertured polymer film sold under the trade name "DRI-WEAVE" by The Procter & Gamble Co., Cincinnati, OH, or an apertured formed film, as disclosed in US Pat. No. 4,629,643, commercially available from Tredegar Film Products, Terre Haute, IN under the designation X27121. First absorbent layer **24** (and second absorbent layer **25**, if used) and breathable backsheet **22** can comprise absorbent materials, and liquid impermeable film materials respectively, as is well known in the art. Extensions **28**, if used, can be integral extensions of the facing layer or the backsheet or both, and they can be symmetric about the longitudinal axis **L**, transverse axis **T**, or both.

Nonwoven webs used in the present invention can be any known nonwoven webs or composites of two or more nonwoven webs. Joining of the facing layer **21** and the first absorbent layer **24** can be provided by any means known in the art, such as by adhesive bonding, thermal bonding, ultrasonic bonding, and the like. Alternatively, the facing layer **21** and first absorbent layer **24** can be joined in selected regions by thermal bonding, for example, by thermal spot bonding.

First and/or second absorbent layer can be Foley Fluff pulp (available from Buckeye Technologies Inc., Memphis, TN) that is disintegrated and formed into a core having a density of about 0.07 grams per cubic centimeter (g/cm^3) and a caliper of about 10 mm.

Joining of the facing layer **21** and the first absorbent layer **24** can be provided by any means known in the art, such as by adhesive bonding, thermal bonding, ultrasonic bonding, and the like. Complete bonding at interface is not necessary in some embodiments. In some embodiments, the facing layer **21** is adhered to the body-facing side of the first absorbent layer **24** at substantially the entire surface interface between the two components, such as by the use of meltblown thermoplastic adhesive. Adhesion can be provided by application of a substantially uniform layer of adhesive applied by means known in the art, such as by spraying or slot coating.

The adhesive, if uniformly coated should not block fluid flow into the first absorbent layer **24**. Therefore, in some embodiments, the adhesive is a fluid permeable adhesive, such as the aforementioned Findley HX1500-1 adhesive.

The absorbent article according to the present invention also comprises a breathable backsheet **22**. The breathable backsheet **22** prevents the extrudes absorbed and contained in the absorbent structure from wetting the articles that contact the absorbent product, such as underpants, pants, pyjamas, undergarments, and shirts or jackets, thereby acting as a barrier to fluid transport. In addition, however, the breathable backsheet **22** of the present invention permits the transfer of at least water vapor, typically both water vapor and air, through the backsheet **22**, and thus allows the circulation of air into and water vapor out of the article. The breathable backsheet **22** typically extends across the whole of the absorbent structure and can also extend into and form part or all of extensions **28**, sideflaps, side wrapping elements or wings, if present.

Suitable materials for use as a breathable backsheet **22** may include a resilient, three dimensional, fluid pervious polymeric web **38,** as show in **FIG. 3**, **FIG. 4A**, **FIG. 4B**, **FIG. 4C** and **FIG. 5**. The polymeric web **38** comprises a first surface **44** and a second surface **54** generally parallel to and spaced apart from the first surface **44**. The polymeric web **38** has a plurality of fluid passageways **40** comprising side walls **46** that extend between the first surface **44** and the second surface **54,** to place the first surface **44** and the second surface **54** in fluid communication with one another. Each fluid passageway **40** has a first opening **42** on the first surface **44,** a second opening **52** on the second surface **54,** and the side walls **46** that connect the first opening **42** to the second opening **52**. The breathable backsheet **22** may be used as a secondary backsheet with a nonwoven backsheet.

The polymeric web **38** of the present invention is comprised of an occluding material **58** that is blended or co-extruded with resins that typically comprise polymeric webs, such as a polyethylene (LDPE, LLDPE, MDPE, HDPE) or laminates thereof. This occluding material **58** causes a mechanical change in the side walls **46** of the fluid passageways **40** upon contact with fluid that renders the first surface **44** and second surface **54** of the polymeric web **38** to be in non-fluid communication with one another at the fluid passageways **40**. This mechanical change may include the side walls **46** of the fluid passageways **40** collapsing and/or adhering to one another such that first surface **44** and second surface **54** are in non-fluid communication with one another at the fluid passageways **40**. The occluding materials **58** may include polymers such as polyurethanes, polyamides, polyester amides, polyether ester amides, cellulose derivatives, alkyl and methyl acrylates, polyvinyl alcohol, poly(2-ethyl oxazoline), polyethyleneimine, polyvinyl

pyrrolidinone, polyamides, polyacrylamide, polymethylacrylamide and metal salts thereof, polyethylene glycol, and copolymers thereof, such as, copolymers of vinyl acetate and ethylene, copolymers of polyureas, copolymers of vinyl acetate and vinyl pyrrolidinone, copolymers of polyether amide, copolymers of polyether ester and the like. The occluding materials **58** may also include polyols such as sorbitol, mannitol, glycerol, sucrose, and the like. The occluding materials **58** may further include plasticizers such as esters of citric acid, triacetin, diacetin, sulfonamides, tartrates, benzoates, adipates, sebacates, sucrose esters, and the like. The occluding material **58** may also include mixtures of the aforementioned polymers, polyols, and plasticizers.

These occluding materials **58** may be blended or co-extruded with typical resins used in polymeric webs. When blended, such as shown in **FIG. 3** and **FIG. 5**, the resilient, three dimensional, fluid pervious polymeric web **38** of the present invention may be a single layer. Alternatively, the resilient, three dimensional, fluid pervious polymeric web of the present invention may be co-extruded with at least another layer, as shown in **FIG. 4A, FIG. 4B,** and **FIG. 4C**. The resilient, three dimensional, fluid pervious polymeric web **38** of the present invention may be joined to at least one other layer, such that it is a double layer. The resilient, three dimensional, fluid pervious polymeric web **38** of the present invention may be joined to at least two layers, such that it is a triple layer. The resilient, three dimensional, fluid pervious polymeric web may be disposed between two or more layers. The occluding material **58** and the other resins can be heated close to their melting point and exposed through a forming screen to a suction force which pulls those areas exposed to the force into the forming apertures which are shaped such that the film is formed into that shape and, when the suction force is high enough, the film breaks at its end thereby forming an aperture through the film.

The occluding materials **58** may be totally exposed, partially exposed or not exposed at the first openings **42** of the fluid passageways **40** when they are formed. **FIG. 4A** shows the fluid passageway **40** of the three dimensional, fluid pervious polymeric web **38** with the occluding material **58** totally exposed at the first opening **42** of the fluid passageway **40**. **FIG. 4B** shows the fluid passageway **40** of the three dimensional, fluid pervious polymeric web **38** with the occluding material **58** partially exposed at the first opening **42** of the fluid passageway **40**. **FIG. 4C** shows the fluid passageway **40** of the three dimensional, fluid pervious polymeric web **38** with the occluding material **58** unexposed at the first opening **42** of the fluid passageway **40**. It is believed that many parameters may allow one skilled in the art to tailor the exposure of the occluding materials. These parameters include, but are not limited to, type of polymer, basis weight of film, process temperature, process speed, air temperature and screen type. For example, if the occluding material **58** is the type of polymer that has higher cohesion and/or higher elongation

than the other resins used in making the polymeric web **38**, the occluding material **58** will become either totally or partially exposed at the first opening **42** of the fluid passageway **40**. Further, if the occluding material **58** has a higher basis weight than the other resins used in making the polymeric web **38**, the occluding material **58** will become either totally or partially exposed at the first opening **42** of the fluid passageway **40.**

As show in **FIG. 3, FIG. 4A, FIG. 4B, FIG. 4C** and **FIG. 5** the fluid passageways **40** may be funnel shaped, similar to those described in U.S. Patent No. 3,929,135. The first opening **42** and second opening **52** of the fluid passageways **40** may be circular or non circular. As seen in **FIG. 3, FIG. 4A, FIG. 4B, FIG. 4C** and **FIG. 5,** the second opening **52** on the second surface **54** may have a cross sectional dimension or area greater than the cross-sectional dimension or area of the first opening **42** located on the first surface **44**. Thus, the fluid passageways **40** in the polymeric web **38** may have a directional liquid transport and be positioned such that they support the prevention of liquid loss (leakage) through the breathable backsheet **22**. The fluid passageways **40** may be evenly distributed across the entire surface of the layer and also may be identical in size.

Various forms, shapes, sizes and configurations of the fluid passageways **40** are possible. The fluid passageways **40** may extend away from the first surface **44** of the polymeric web **38** for a length that typically may be at least in the order of magnitude of the largest diameter of the opening while this distance can reach up to several times the largest opening. The fluid passageway **40** may have a first opening **42** in the plane of the first surface **44** of the film and a second opening **52** which is the opening formed when the suction force (such as a vacuum) in the above mentioned process creates the aperture. Naturally, the edge of the first opening **42** may be rugged or uneven, comprising loose elements extending from the edge of the opening. However, in most embodiments, the opening may be as smooth as possible, so as not to create a liquid transport entanglement between the extending elements at the end of the first opening **42** of the fluid passageway, with the first absorbent layer **25** in the sanitary napkin **20.**

FIG. 5 shows the three dimensional, fluid pervious web of the present invention showing that fluid passageway **40** comprises a first opening **42** having a center point **48** and the second opening **52** also having a center point **56**. The center points **48, 56** for non-circular openings are the area center points of the respective opening area. A center axis **50** is defined when the center point **48** of the first opening **42** are connected with the center point **56** of the second opening **52.** This center axis **50** forms an angle **60** with the plane of the polymeric web **38,** which is the same plane as the first surface **44** of the polymeric web **38**. In most cases, the fluid passageways **40**

extend away from the first surface **44** of polymeric web **38** at an angle **60**, which is less then 90 degrees. In some embodiments, the angle **60** may range between 85 and 20 degrees. This angle **60** may also range, between 65 degrees and 25 degrees. This angle **60** may also range, between 55 and 30 degrees.

The fluid passageways **40** may take the shape of a funnel such that the first opening **42** is substantially smaller than the second opening **52** when considering the opening size in a plane perpendicular to the center axis **50**. The fluid passageways **40** may be curved along their length towards the first surface of the polymeric web **38**.

Methods for making such three-dimensional polymeric films with capillary apertures are identical or similar to those found in the apertured film topsheet references, the apertured-formed film references and the micro-/macroscopically expended film references such as U.S. Patent No. 4,637,819 and U.S. Patent No. 4,591,523.

The plurality of the fluid passageways **40** and the angle **60** of the fluid passageways **40** allows the polymeric web **38** to be air and vapor permeable. The occluding material **58** comprised in the polymeric web **38,** allows the polymeric web **38** to be an effective moisture barrier. Without wishing to be bound by theory, it is believed that when the side walls **46** of the fluid passageways **40** are contacted with fluid, the side walls **46** of the fluid passageway **40** undergo a mechanical change, such as, collapsing and/or adhering to one another. The collapse and/ or adherence causes the first surface **44** and the second surface **54** of the polymeric web **38** to no longer be in fluid communication. When the first surface **44** of the web and the second surface **54** of the polymeric web **38** are no longer in fluid communication an effective moisture barrier is formed.

All documents cited in the Detailed Description of the Invention are, in relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it is prior art with respect to the present invention.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.